correlation between parent and offspring in characters subject to normal, or "fluctuating," variation, if such variations are not in fact transmitted.

R. P. BIGELOW
MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
BOSTON, MASS.

AGGREGATE MUTATION OF GOSSYPIUM

DR. O. F. COOK, in his official work for the U. S. Department of Agriculture, has observed several instances of abrupt change *en masse* of the distinguishing characters of varieties of cotton, full results of which he is preparing to publish. Some of those transmutations have occurred in connection with geographical transference, and some have not. Central American varieties on being brought to the United States have shown entirely distinct characters of habit and growth in all the plants from and after their first planting. In case of the well-known and long-cultivated upland cotton of the United States, he found all the individual plants of a whole planting to have become thus abruptly changed. The change involved the whole field crop of a planting, and the new crop differed equally from both the parent stock and the plantings of the same stock in other fields in the same season.

Dr. Cook properly regards these transmutations as identical in character with those which I have observed in the tomato and which in several publications I have designated as aggregate mutation. See especially *Popular Science Monthly*, Vol. LXVII., No. 2, June, 1905.

CHARLES A. WHITE

SPECIAL ARTICLES

THE CHROMOSOMES OF ŒNOTHERA

ON account of the general interest which attaches to this subject, it may be well to present some further facts, and also to review briefly our knowledge of the subject as developed up to the present time. The work is being continued upon a large amount of material collected during the summer from a culture which consisted of 1,700 pedigreed individuals, partly from pure races, and partly from guarded crosses. The collections made from each individual were kept separate from all others for examination. My work on the subject was begun on plants grown at Woods Hole, Mass., from seeds of DeVries, in 1905.

In December, 1906,[1] some of this work was reported upon. *O. lata* from a cross was found to have 14 chromosomes as sporophyte number, but quite unexpectedly one of the other plants from what was believed to be pure seeds of *O. lata* × *O. Lamarckiana* were found to contain 20 chromosomes. This result was published in a paper[2] on the abortive pollen development in *O. lata*, but it was discovered by the writer[3] a little later that *O. Lamarckiana* itself had 14 chromosomes. This result was afterwards confirmed by Miss Lutz,[4] and Geerts in a short paper[5] published the same result. After my first announcement of results Miss Lutz germinated seeds of several forms and examined the root-tips of the seedlings, finding[4] about 14 chromosomes in *O. Lamarckiana*, as already stated, but 28 or 29 in *O. gigas*.

I have since reported[6] 14 chromosomes in the *Lamarckiana* plants from *O. lata* × *O. Lamarckiana* as well as in the *O. lata* from this cross, also in *O. rubrinervis* and in *O. nanella;* together with various peculiarities of the reduction mitoses in the pollen mother cells of these forms. One of these interesting features is that sometimes in the heterotypic mitosis one chromosome passes to the wrong pole of the spindle, thus probably introducing

[1] American Association for the Advancement of Science, New York meeting.

[2] "Pollen Development in Hybrids of *Œnothera lata* × *O. Lamarckiana*, and its Relation to Mutation," *Bot. Gazette*, 43: 81–115, 1907.

[3] "Hybridization and Germ Cells of Œnothera Mutants," *Bot. Gazette*, 44: 1–21, 1907.

[4] "A Preliminary Note on the Chromosomes of *Œnothera Lamarckiana* and one of its Mutants, *O. gigas*," SCIENCE, N. S., 26: 151–152, August 2, 1907.

[5] "Über die Zahl der Chromosomen von *Œnothera Lamarckiana*," *Ber. deut. Bot. Gesells.*, 25: 191–195, 1907.

[6] International Zoological Congress, Boston, August 22, 1907.

an irregularity in the chromosome numbers of the next generation. This is especially common in the hybrids. An irregularity of this kind is probably the cause of the 15 chromosomes found by Miss Lutz[7] in one *O. lata* plant. Such irregularities will probably also explain other variations of one or two in the chromosome numbers, including the 20 instead of 21 chromosomes in what I have now shown to be an *O. lata* × *O. gigas* hybrid.

The long-believed tendency to wide variability in the number of chromosomes in root-tips made it important that the count made by Miss Lutz in *O. gigas* should be confirmed. I have recently examined the reduction mitoses in the pollen mother cells of *O. gigas* and also find the number to be 28, the reduced number being 14. The material for this study was obtained from A. C. Life, now of the University of Southern California. It was collected by him at Woods Hole, Mass., in the summer of 1905, from plants growing side by side with those from which my first material was collected.

I have also recently examined material from another plant in the cross which was believed to be pure *O. lata* × *O. Lamarckiana,* but which appeared to have all the characters of *O. gigas* and was found to have 21 chromosomes. This, with other evidence, furnishes definite proof that the cross which was believed to be pure had been partly pollinated with *O. gigas.* The interesting feature about this plant is the manner in which the chromosomes segregate in the heterotypic mitosis.

Almost invariably 10 chromosomes go to one pole of the spindle in the heterotypic mitosis in the pollen mother cell, and 11 chromosomes to the other pole. It is difficult to see how this can be interpreted in harmony with current views of the homology of maternal and paternal chromosomes. For even although we assume that in the reduction of chromosomes in the hybrid the descendants of the 7 *lata* chromosomes in the cross always pair with the descendants of 7 of the 14 *gigas* chromosomes, the remaining 7 *gigas* chromosomes are invariably distributed as though they paired with each other, with the exception, of course, of the unpaired chromosome which (when one is present) may go to either pole of the spindle according to chance. In other words, the chromosomes are invariably distributed as though 10 of them were homologous with the other 10, which is not the case when their origin is considered.

How the *O. lata* × *O. gigas* hybrid, which matures an abundance of pollen, will behave in later generations, is not known. A little thought will show that if the chromosomes always segregate in germ-cell formation in the manner described above, by crossing the hybrid with the parental types and judiciously re-crossing, in later generations plants may be obtained having all sporophyte numbers of chromosomes between 28 and 14, or reduced numbers between 14 and 7; and whenever the sporophyte number was an uneven one the plant would produce two kinds of germ cells, differing by one in their chromosome number. The writer hopes to carry some of these crosses forward in the future, as it is believed that they should throw light on the nature of a chromosome in its relation to somatic characters in heredity.

The early history of the bodies designated heterochromosomes is not yet fully worked out, but they are evidently not directly connected with the chromosomes, although frequently almost identical with them in appearance in the metaphase of the heterotypic mitosis. It is believed that these bodies will be found to be more nearly related to the ordinary nucleoli than to the chromosomes.

Resuming briefly, we may say that *O. Lamarckiana, rubrinervis, nanella,* as well as both the *lata* and *Lamarckiana* types arising from *O. lata* × *O. Lamarckiana,* have 14 chromosomes, with perhaps occasional departures of one from this number. *O. gigas* has 28 chromosomes, and certain plants appearing in the first hybrid generation of *O. lata* × *O. gigas* having almost or quite the identical appearance of *O. gigas* have 21 chromosomes (20 in one plant), the latter segregating equally in reduction, with the ex-

[7] International Zoological Congress, Boston, August 22, 1907.

ception of the unpaired chromosome, which passes to one pole of the spindle.

R. R. GATES

UNIVERSITY OF CHICAGO

CURRENT NOTES ON METEOROLOGY AND CLIMATOLOGY

CHANGES OF CLIMATE?

IN his recent volume (Vol. II.) on "Ancient Khotan," Dr. M. A. Stein, whose explorations in Chinese Turkestan are well known, points out that it requires constant and persistent effort to keep up the irrigation of the oases in that region. The wind-blown sand and the shifting courses of the silt-laden, snow-fed rivers are always tending to change the course and scope of the irrigation systems. If man relaxes his efforts in the least, the sand and the aridity of the desert replace the fertility of the formerly irrigated oasis. This has happened in many cases within human experience. A swing of the climatic pendulum in this region, towards a drier period, is not thought improbable, but the ordinary physiographic forces at work there are held sufficient to explain the changes of population and of settlements which have been clearly made out.

Again, in the Lake Chad district of Africa, Lieutenant Secker, in northern Nigeria, has lately reported that he found that the natives, by erecting fish-dams on the river Yo, are diverting water which would otherwise flow into the lake. These dams collect large masses of weeds, and lead to the formation of marshland. Lieutenant Secker is of the opinion that this may have something to do with the reported drying-up of Lake Chad.

FOG DENSITIES

The Quarterly Journal of the Royal Meteorological Society for October, 1907, contains a suggestion by J. A. Lovibond, "On a Method and Apparatus for Measuring Fog Densities." The method is based on the power of selective absorption of suitably colored glass. When this has been graded into mechanical scales of equivalent color value, a beam of white light can be progressively absorbed to extinction, and the luminous value of each successive absorption stated in quantitative terms. This analytical power also applies to the color constituents of the beam.

RAIN GAUGES

The Quarterly Journal of the Royal Meteorological Society for October, 1907, also contains a paper, by Dr. H. R. Mill, on "The Best Form of Rain Gauge, with Notes on Other Forms." Dr. Mill strongly recommends the "Snowdon pattern," which is 5 inches in diameter; has a vertical rim to the funnel of 4 inches, and has an inner can and also a bottle.

NOTE

The Annuaire Météorologique of the Royal Observatory of Belgium for 1907 contains a discussion, by A. Lancaster, entitled "L'Humidité de l'Air en Belgique," and an account of balloon ascents in Belgium by J. Vincent.

R. DEC. WARD

HARVARD UNIVERSITY

THE IOWA LABORATORIES OF ANIMAL BIOLOGY

AT the University of Iowa, new laboratories of animal biology have just been put into service under the directorship of Professor Gilbert L. Houser. These laboratories are located in a new and beautiful fire-proof building of thoroughly modern construction—the hall of natural science, erected by the state at an expense of three hundred thousand dollars. With the standard of their new quarters, the laboratories are entirely in keeping, so it is evident that the opening of these laboratories marks an epoch in the scientific facilities of Iowa.

The space devoted to animal biology comprises eleven rooms located in the north wing of the building on the second, the first, and the basement floors. This space is so unified, however, by a small elevator running through the rooms as to make the arrangement much more convenient than if all the space were on one floor.

The laboratories proper occupy the whole of the second floor of the north wing, the large